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SOME HYBRID MARTAGON LILIES

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Bureau of Plant Industry

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By David Griffiths, *senior horticulturist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry*

CONTENTS

	Page
Origin	1
Probable parentage	1
The progeny and its segregation	2
Adaptability	3
The propagation	3
Method of scaling	4
The bulbs	4
Conditions of culture	5
Health of the stocks	5
Varieties named and described	6
Peter Puget (1572)	6
Frances Larrabee (1369-K)	7
Mercer Girl (1369-A)	7
Varieties named and described—Continued.	
Vashon (1369-G)	8
Cyrus Gates (1370-S)	8
Star of Oregon (1370)	9
Sacajawea (1370-D)	9
Kulshan (1370-O)	10
John McLaughlin (1370-I)	10
Douglas Ingram (1370-R)	11
Shuksan (1370-F)	11
Season of blossoming	12
Similarities and relationships	12
Prospects of further breeding	13

ORIGIN

In May 1919 the writer visited The Terraces, owned by Carl Purdy, near Ukiah, Calif. During a discussion of the culture of lilies from seed, Mr. Purdy exhibited 4 or 5 ounces labeled *Lilium humboldti magnificum*, stating that it was from plants cultivated by one of his correspondents who delighted in mixing things up, but seemed not to be particularly interested in doing anything further than producing the seed.

About 2 months later 3 ounces of this seed was purchased for use in the investigations of the Bureau of Plant Industry at the United States Bellingham Bulb Station,[1] Bellingham, Wash. It was sown in late summer and germinated the second spring, making a uniform, rather thin stand. Not until the summers of 1923 and 1924 was the pronounced hybrid nature of the progeny fully appreciated.

Mr. Purdy was then appealed to for information as to the identity of the hybridizer. He replied that he had entirely forgotten from whom the seed was received. At the present time, therefore, the identity of the one who did the job of "mixing" is not known.

PROBABLE PARENTAGE

Subsequent experience indicates that whoever did the work of pollinating used effectively some form of *Lilium humboldti*, *L. parryi*, and *L. pardalinum*. Results of the use of all of these seem to be present in the progeny. It seems also that the maternal side was consistently *L. humboldti*. The seed appeared to be uniform and

[1] Hereinafter referred to as the Bellingham Bulb Station.

identical with that of the Humboldt lily. Had there been seed of the other species, it would have been detected, for they are quite distinct. From these observations it is thought that the hybridizer used the Humboldt lily in some of its forms as the seed parent, gathered the seed, and furnished it as that of "*L. humboldti magnificum.*" It must be distinctly understood that the parentage indicated later in this circular under the different varieties represents the opinion of the writer based on subsequent experience in breeding experiments with these species. *L. parryi* Peter Puget is not included with these. This was a cross of *L. pardalinum* on *L. parryi*, made at the Bellingham Bulb Station.

All of the varieties described here are plainly referable to the Martagon section of the genus *Lilium*. The section is typified by the Eurasian species *Lilium martagon*, as well as by the common turkscap of the eastern United States. The group is readily recognized by its inverted flowers and recurved petals.

THE PROGENY AND ITS SEGREGATION

A total of fully 3,000 plants were produced from the seed purchased from Purdy, who sent to the Department all he had instead of the 3 ounces ordered. At that time lily seed had little value, as its potentiality in working up stocks was not generally appreciated as it is today, and there was consequently little market for it.

There was scarcely a seedling in this entire progeny that would not have made a desirable garden ornament. Indeed, many of those discarded were fully as handsome as the ones selected and described in this circular.

The nature of the seedlings was fairly evident in 1923, but it was not until 1924 that the planting impressed the writer as being worthy of careful study, selection, and propagation, for the purpose of establishing horticultural varieties. In late July 1924, therefore, when the stocks were in blossom, about 3 dozen individual seedling bulbs were selected as the basis of clons, and propagations of each were started.

The selections were arranged in two series under the station's inventory nos. 1369 and 1370; the first series contained those seedlings considered to be derived from *Lilium parryi* on *L. humboldti*, and the second the seedlings thought to be derived from *L. pardalinum* on *L. humboldti* or its variety. Reselections and eliminations during the 7 years following 1924 have for various reasons reduced the list to 10, which are thought worthy of perpetuation. Others in the list are just as good in every way but are too near the same in character to be named. One or two are even more handsome but do not propagate well. They will be retained for further breeding.

It should be emphasized that the basis of each one of these varieties is a single seedling, selected from the general stock in July 1924. Each lot should, therefore, be uniform. The only variation likely to occur is from inadvertent mixture with other lots, which might happen in any bulb business. Extreme care is necessary to prevent a scale of a variety from adhering to the sides of the container, to be loosened when the same container is used in the transportation of the next variety. Visitors at the Bellingham Bulb Station have been invariably impressed by the uniformity of these selections. The method of their development precludes anything else, and this is the only method that will give uniformity.

ADAPTABILITY

Eagerness to increase stocks so that lily growers in general may get started in the culture has prevented the sacrifice of any of the bulbs for border tests in the East on the "let alone" plan so much employed in the culture of lilies. The handling has been entirely on a field basis, with biennial digging, which is a more severe test. An indication of what these lilies will do in borders, however, is not wanting. An unnamed seedling closely akin to and resembling Douglas Ingram was grown by C. T. Canfield at Bellingham, Wash., for 6 years undisturbed in a herbaceous border in heavy clay soil. The last year it produced 32 flowering stalks from a mass of bulbs three layers deep, no stalk bearing less than a dozen flowers. One half of a double-nosed bulb was planted. There were close to 50 crowns for the seventh year's performance.

THE PROPAGATION

The task of building up stocks began about the middle of August 1924, immediately after the digging of the unit progeny bulbs selected in July. Each bulb was scaled moderately, every scrap of bulb tissue being planted beside the core of the scaled bulb. The progenies had to be dug again in 1925, because it was found that the soil condition was not suitable, owing to poor drainage. Again the stocks were scaled moderately; even the 1-year-old bulbs, none of which blossomed but many of which produced stems, were deprived of some of their outer scales, which were planted beside the bulb cores as before.

The 1925 plantings were left undisturbed for 2 years. In 1927 they were dug and scaled again, the scales this time being planted in a separate situation. In 1928 it was decided to dig the scale propagation of 1927 in mid-August. This is not usually done, but the planting seemed too thick to be left another year. The planting of old cores was not disturbed.

It was here that the first and only disaster occurred in the increase of stock of these hybrids, and something was learned that should have been known before. For some reason it was not realized that although old bulbs of these lilies can be dug profitably for propagation as the blossoms fade, it is not safe to dig the 1-year-old bulbs until they are mature. Such premature digging, however, had been successful twice, but it failed the third time. The result was that only the largest bulbs grew and the smaller ones rotted. Not less than three fourths of this propagation was lost through this faulty handling. However, two of the most vigorous varieties had negligible losses.

In 1929 the old cores planted in 1927 were lifted, scaled, and put back again. They had grown to maximum-sized bulbs and many had split. The bulbs selected in 1924 (Peter Puget included) had increased to such an extent that it was possible in 1929 to remove 65,000 scales and still have the old cores to reset.

In 1931 all the stocks were again lifted, two more were discarded, five were placed with growers to develop for public consumption, and the remainder were propagated for further increase of stock. It is expected that lily growers will be able to offer a small number of Shuksan, Kulshan, Douglas Ingram, Star of Oregon, and Sacajawea in 1933.

METHOD OF SCALING

Since scale propagation will be the main commercial method of increasing stock of these hybrids, it will be important to know definitely how the process has been carried on. In working up stocks two methods have been employed, one by scales (pl. 1, A) and the other by natural division of the bulbs (pl. 1, B). The latter takes place naturally, without manipulation on the part of the grower; the former needs elucidation.

The bulbs have been dug and scaled some time between July 20 and August 15 with good success, sometimes in full flower. They have always been dug and put back within a week. The bulbs are dug, scaled, treated if treatment is thought necessary, and planted as soon as convenient, at times only a day or two intervening between digging and planting. The handling of the dug bulbs has been done in a bank cellar closed up so as to cause a minimum of desiccation.

The scaled bulbs have been planted in 3-foot beds, about 7 by 9 inches apart. The scales are put in 2 inches deep, about 50 to 3-foot rows which are 6 inches apart. At times the planting has been shallower and a little soil has been added late in the fall to bring the covering up to 2 inches over the bulblets.

It has been considered advisable to mulch the scale planting sufficiently to keep the ground from freezing. The hay or straw used for this purpose has been put on toward the first of December and taken off toward the first of March. Biennial digging has been practiced with both bulbs and scales. This is considered advisable when stock is being worked up, and mulching is considered advisable both years because of the shallowness of the bulbs. Summer mulching has also been practiced with the scale propagation, it being applied on the 10th to the 15th of May after danger of frost is over.

The extent of scale removal is important, as this is a factor in the rapidity with which stocks may be multiplied. It has been the practice to scale the mature bulbs down to the new crown. Plate 1, A, shows better than words just how this is done. It is considered that bulbs scaled in this way get back to normal in 2 years and may be scaled again. The young bulbs that have not reached maturity—those 2 years from scales—are scaled very lightly, if at all, but at the second biennial digging they are scaled as shown in plate 1, A.

There is a great difference in the rapidity with which stocks may be increased in these hybrids. The best propagators are Shuksan and Kulshan; Star of Oregon is the next best, and following it are Douglas Ingram, Sacajawea, and Cyrus Gates; the slowest are those derived from *Lilium humboldti* and *L. parryi*. Peter Puget of *L. pardalinum* on *L. parryi* derivation is a good doer.

THE BULBS

The bulbs of these hybrid lilies are tremendously variable in almost every particular. Those of Peter Puget resemble in a general way those of *Lilium pardalinum*. All the others follow the lines of the Humboldt lily bulb more closely. Some may appear to have scales entire or nearly so, while others have their scales conspicuously jointed.

It is difficult to determine whether there is any real difference in the color of any of these bulbs. When freshly dug some may have purple

A, Bulbs of one of the hybrid lilies, showing the extent to which they are scaled for increasing stock. B, A clump of one of the hybrid lilies, closely resembling Douglas Ingram, after remaining in a herbaceous border 6 years undisturbed.

tips to their scales while others are a creamy yellow. All of them turn purple upon exposure; consequently the purplish tips in some may be simply a reaction to exposure. All the bulbs having *L. humboldti* as the maternal parent possess the bitter principle so pronounced in this species.

Every degree of stem rooting is exhibited in these hybrids. Those varieties derived from *Lilium parryi* are said to be nonstem rooting, but show a few stray roots occasionally, and while Cyrus Gates is as densely stem rooting as the goldband lily, in John McLaughlin the stem roots are very sparse.

CONDITIONS OF CULTURE

The culture of these lilies for the most part has been on Whatcom silt loam. For the first 2 years from the planting of the seed, culture was on a Lynden sandy loam recently removed from the forest and without the use of fertilizer. From 1923 to 1925, inclusive, the stocks were planted in Whatcom silt loam that had received an application of 2 tons of ground limestone per acre in 1918. This is a heavy soil 10 to 12 inches in depth overlying a dense clay. From August 1925 to August 1931, the character of the soil was varied and difficult to classify. The plantings have been on the edge between Lynden gravelly loam and a heavy black clay. With all the soil there has been a considerable admixture of Whatcom silt loam. The appearance of the worst of this black soil, of which there was not a large percentage in the cultures, reminds one of the black waxy soil of Texas. There is enough of it in the soil to prevent a plow from scouring except when plenty of moisture is present.

The stock has been kept in good condition most of the time. Greater imperfections were found at the 1929 digging than at any other time, and it is thought that the soil condition was responsible. The heavy black soil packs and solidifies, preventing the free passage of water through it, especially the second year. There were no losses, but the outer scales of a small percentage of the bulbs were partly rotted.

HEALTH OF THE STOCKS

The general health of the bulbs has been good. It was just about perfect until 1929 to 1931, when, in addition to the deleterious soil conditions already mentioned, the low-lying ground made for a frosty condition from which these varieties, in common with other lilies, suffered considerably. In the season of 1929 there was scarcely a perfect panicle of inflorescence in any of the progenies; however, they suffered less than the species from which they were derived, although the general aspect of the beds was good. There were dead buds and leaves and often dead patches on the stems, typical fire-blight conditions brought about by repeated frosty nights, excessive rainfall, and low temperatures from the time the plants came up until well into May. That the frosty, wet weather is responsible for the rapid development of the blight organism (*Botrytis elliptica*) is amply proved by comparison with the perfect condition of some plants of these progenies moved into the protection of walls of houses and into the unheated greenhouse. These hybrids suffer far less from frosty conditions than does *Lilium humboldti*, the mother of all but one of them.

There was a little rust (*Uromyces lilii*) in these stocks from the start. It came in on locally collected bulbs of *Lilium columbianum*. Dusting the growing plants with flowers of sulphur and spraying with Bordeaux mixture were resorted to, but the result was not satisfactory. Finally in the propagating season of August 1929 the worst infested plants were washed with a strong spray of water and all were thoroughly dusted with sulphur. A practical clean-up was effected. Both bulbs and scales were put in a cloth sack with suitable amounts of sulphur. Ending the sack up gently a few times was sufficient to thoroughly coat the entire surface. The contents were then emptied onto a fine screen which removed the excess of sulphur.

VARIETIES NAMED AND DESCRIBED

In naming the varieties an effort has been made to connect these hybrid lilies with the land of their origin, where all of them are well adapted. No experience has been had with them in any other region. On Puget Sound they are all more robust than their parents, and all are more amenable to culture than *Lilium humboldti*, which is one of the handsomest of the world's lilies.

The writer's color descriptions of the flowers have been amended to conform with the color readings made by L. C. C. Krieger in 1931, when he made water-color illustrations of the flowers. The color nomenclature is based on Ridgway.[2]

Colored illustrations of all the lilies were prepared on a plan comparable with that of plate 2. Plates 3 and 4 show the inner petals of their respective varieties. In the preparation of these illustrations the petals were removed from the flowers at full anthesis, spread out as smoothly as possible between two pieces of glass, and photographed in these positions. Dim, gray photographic prints on a heavy sensitized paper having a minimum of film were used on which to superimpose the color.

PETER PUGET (1572)[3]

(*Lilium pardalinum* on *L. parryi*. Pl. 2 and pl. 5, A)

Peter Puget, whose name has been given to the variety described below, was a lieutenant under the command of Capt. Vancouver during the survey of the northwest coast.

Plants 4 to 5 feet high, dull light green with stems green except at very base; leaves variable in position and arrangement throughout, whorled, half whorled, alternate, and spiraled, seldom more than 1 or 2 perfect whorls and these near top, dull green above and below, 3-ribbed, hispidulous to the touch on edges and midrib on lower side, edges uniform and straight, commonly 15 mm wide by 12 to 14 cm long, widest about middle and tapering to a 3 to 4 mm wide attachment below and to an acuminate point; inflorescence pyramidal, 15 or more flowered, the lower pedicels 16 to 17 cm long; buds green, developing a distinct blush of red toward anthesis; flowers variable in color, capucine yellow toward base but with uniform or blotched overlay of red distally, spotting extending two thirds over surface, the outermost scattered and surrounded by zone of yellow in the lake of red, black, about 1 mm in diameter, smaller and without halo in slightly ridged throat, base green; anthers dull purplish-red with dull yellowish stripe down back rib, pollen Mars orange; nonstem-rooting, good reproduction at base; bulb flattened, angular under cultivation, becoming 8 to 10 cm in diameter in 2 years from single-nosed bulbs, scales 2 to 3½ cm long, 2 to 4, mostly 3-jointed, fragile, basal plate thick, heavy and fleshy, white or yellowish on old scales, turning purple slowly on exposure.

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[2] RIDGWAY, R. COLOR STANDARDS AND COLOR NOMENCLATURE. 43 p., illus. Washington, D.C. 1912.

[3] The figures in parentheses following the names are inventory numbers of the Bellingham Bulb Station.

Lilium burbanki of European growers resulted from the same cross as Peter Puget and is similar but evidently derived from two or more seedlings. Peter Puget differs in vegetative characters, in having larger flowers and larger dots, and in having buds with red near tips instead of a uniform blush. It is the only variety described here resulting from pollinations made at the Bellingham Bulb Station. Like the others, it is derived from one seedling.

FRANCES LARRABEE (1369-K)

(*Lilium parryi* on *L. humboldti*. Pl. 3, C, and pl. 5, B)

It was Mrs. Frances Larrabee's generosity in donating land for a commodious station that made it possible for these lilies to be developed. It is fitting that this beautiful, glossy, orange turkscap receive her name.

Plants under field conditions and rapid propagation 6 to 7 feet high, medium green; stems mottled, green and dark brown to black at base, slightly hispidulous to the touch; leaves dull above and glossy below, alternate above and below and whorled between, 10 to 15 to the whorl, 2 cm broad and 13 to 15 cm long, acuminate with margins slightly wavy, indistinctly 3-nerved above and plainly so below; inflorescence pyramidal, 20 to 30 flowered, the lower pedicels 13 to 15 cm long; buds green, turning yellow toward anthesis with spots showing through faintly; flowers half martagon in position, facing at an angle of 45° with the horizontal, bright deep cadmium yellow, paler at tip and base with reverse lighter and dull, sprinkled uniformly except for small tip with burnt sienna colored dots, 1 to 1½ mm in diameter, nearly smooth throated and green based, 17 to 20 cm in diameter, with petals about 2 cm broad, gradually narrowed to pointed tip, broadly arched backward but not tightly recurved; anthers dull yellow, purplish tinged on edges, pollen raw sienna; nonstem-rooting; bulbs oval with progressing point of rhizome pointing obliquely downward, 9 to 10 cm in diameter, white to yellowish with tip of upper scales purplish tinged, coloring on exposure, outer scales faintly and inner ones conspicuously jointed, 4 to 6 cm but mostly 5 cm long and 1 cm wide.

Frances Larrabee is a distinct and beautiful lily, both floriferous and robust. However, like the other *Lilium parryi* hybrids it is not so vigorous as those derived from *L. pardalinum* × *L. humboldti*. It is commonly 6 to 7 feet high and bears 30 flowers under field conditions the second year after the bulbs are closely scaled.

MERCER CIRL (1369-A)

(*Lilium parryi* on *L. humboldti*. Pl. 3, D)

Mercer Girl is named in commemoration of an interesting incident in the early history of the Pacific Northwest.

Plants under field conditions and rapid propagation 5 to 6 feet high, smooth; medium green; stems mostly green and dark brown, flecked and black at base, leaves 8 to 14, alternate above and below and whorled between, 12 to 14 mm wide and 12 to 15 cm long, faintly 3-nerved above and plainly so below, not wavy margined but faintly hispidulous to touch like stems; inflorescence pyramidal, 12 to 20 flowered, with basal pedicels 15 cm long; buds green to dull yellow at anthesis with spots showing through faintly; flowers glossy, light cadmium, lighter at tip and base, lighter and duller on the reverse with spots showing through on edges, very faintly ridged in throat on inner petals only, green in base, spots small, mahogany red, black toward center but more red outward and distal 1½ cm free and a lighter, duller yellow, arched backward, 15 to 17 cm in diameter; anthers dull yellow with edges or areas purplish tinted and pollen xanthine orange but frequently yellow at ends of the anther; rarely with a few stem roots; bulbs mostly oval, 7 to 8 cm in diameter, with progressing point of rhizome pointing obliquely downward, white or yellowish on outside, coloring on exposure, scales jointed, about 5 cm long.

The variety differs from Frances Larrabee mainly in being lighter in color and having narrower, flatter leaves. The discussion of relation ships appears on page 12.

VASHON (1369-G)

(*Lilium Parryi* on *L. humboldti*. Pl. 3, E)

On the island of Vashon was organized the first lily-growers' association of this country or any other so far as records show. The Vashon lily is named for this island, which seems so well adapted to lily culture.

Plants under field conditions and rapid propagation 5 to 6 feet high, medium green; leaves 10 to 14, whorled but alternate above and below, 23 to 25 mm broad, 15 to 18 cm long, 3-nerved, faint above and prominent on glossy under surface; inflorescence pyramidal with lower pedicel 18 cm long, 18 to 20 flowered; buds green, turning dull yellowish with spots showing through faintly; flowers 18 cm in diameter, glossy, between lemon chrome and light cadmium with throat wide, scarcely perceptibly ridged, green based with spots which are more red but only slightly larger outward, between Mars orange and burnt sienna, covering all but the outward 1 to 2 cm of petal, small, only 1 to 2 mm in diameter, reverse dull yellow with spots showing through faintly; anthers dull yellow with usually a faint tinge of purplish red on portions of sutures and pollen Mars yellow; non-stem-rooting except very rarely; bulbs shaped like those of Mercer Girl, rather looser in texture, scales long, 1 cm wide and commonly 8 cm long, pointed, white to yellowish white, scarcely tinted at all at apex of shallow-planted bulbs but changing color on exposure, like Frances Larrabee and Mercer Girl. Not splitting much at bulb in 2 years.

Vashon differs from Frances Larrabee and Mercer Girl in being still lighter in color of the flower. The three may be looked upon as forming a series in color from deep cadmium orange to almost lemon yellow, with Mercer Girl midway between the yellow of Vashon and the orange of Frances Larrabee.

CYRUS GATES (1370-S)

(*Lilium pardalinum* on *L. humboldti*. Pl. 4, D, and pl. 6, A)

The late Cyrus Gates was associated with Mrs. Frances Larrabee in the donation of the land dedicated to bulb culture at Bellingham, Wash. He contributed much to the establishment of the station.

Plants 5 to 6 feet high under field culture and excessive propagation; light green (lighter than John McLaughlin); stems bronzed at attachment of leaves and elsewhere and black at base; leaves, 12 to 16, whorled with few alternate above and below, slightly wavy margined, minutely papillate and faintly hispidulous, dull above and glossy below, 2 cm wide and 14 cm long, pointed, 3-nerved; inflorescence pyramidal, 12 to 20 flowered, with lower pedicels 17 cm long; flowers of true martagon type, cadmium orange, reverse same but dull with spots on edges, petals reflexed, about 9 cm long, outer with edges at base tightly incurved but inner expanded, throat ridged in sharp raised lines, greenish based, deep orange, covered, except 1 to 2 cm of tip, with dots which are small and black in throat but often 4 mm in diameter distally, surrounded by a reddish zone and showing a slight tendency to coalesce, reverse clear orange with dots showing through clearly on edge and faintly in center; anthers dull yellowish with purplish margins and dark orange rufous pollen; stem rooting but not always abundantly; bulbs oblong with horizontal base, showing tendency to make crowns on each side of flowering stem, white, yellow exteriorly, turning purple on exposure, 8 to 10 cm in greatest diameter, scales jointed, but many entire with wide, dilated, enveloping bases, mostly 12 to 20 mm wide, about 5 cm long when jointed but longer and wider when entire, old scales wrinkled.

This is one of the most brilliant lilies and is a vigorous, robust grower.

L. C. C. Krieger, Pinx.

Peter Puget flowers and unopened fully developed bud.

Lith. A. Hoen & Co., Inc.

L. C. C. Krieger, Pinx

Inner petals: A, Douglas Ingram; B, Sacajawea; C, Frances Larrabee; D, Mercer Girl; E, Vashon.

Lith. A. Hoen & Co., Inc.

L. C. C. Krieger, Pinx.

Inner petals: A, Star of Oregon; B, John McLaughlin; C, Kulshan; D, Cyrus Gates; E, Shuksan.

Lith. A. Hoen & Co., Inc.

STAR OF OREGON (1370)

(*Lilium pardalinum* on *L. humboldti*. Pl. 4, A)

The name assigned to this lily relates to an incident in the history of old Oregon. *Star of Oregon* was a boat built in the lower Willamette to carry three men to California to bring cattle for the establishment of a livestock industry in the Territory.

Plants 6 to 7 feet high, medium green, faintly puberulent with small papillae on stems and edges of leaves, barely noticeable to the touch, bronzing very slight except at base where stems are deep brown; leaves, 13 to 18, whorled except a few below, commonly in two ranks, about 16 cm long and 2 cm wide, 3-nerved, dull green above and glossy below; inflorescence pyramidal, 2 feet long when fully matured, 14 to 20 flowered, with lower pedicels 14 to 15 cm long; buds green, turning orange with distinct reddish blush; flowers true martagon, reflexed, cadmium orange, 16 cm in diameter, throat broad ridged, green at base, spots extending over entire petal, black in throat, and 1 to 2 mm in diameter, enlarging outward to 3 mm, mostly distinct with red zones coalescing slightly in places, reverse orange with tinge of red on ribs, spotting showing through especially on edge; anthers purplish on sutures, especially at middle, and pollen orange rufous; nonstem-rooting with rhizome pointing downward at an oblique angle; bulbs yellowish white, 8 to 9 cm in greatest diameter, scales jointed, 5 to 6 cm long and 8 to 10 mm broad, pointed, showing tendency to produce two crowns on same side of stem.

See notes under Sacajawea, below. Star of Oregon is a robust, tall, strong variety.

SACAJAWEA [4] (1370-D)

(*Lilium pardalinum* on *L. humboldti*. Pl. 3, B)

The Sacajawea lily is dedicated to the memory of the Shoshone Indian woman who so faithfully, efficiently, and heroically piloted Meriwether Lewis and William Clark into and through the great Northwest Territory.

Plants tall, robust, 6 feet high under field conditions and rapid propagation, medium green, with stems bronzed at whorls of leaves, irregularly otherwise and black at base; leaves, 18 to 24, whorled except at base of stem, often in 2 or 3 rows and not infrequently spiraled, 3-nerved and often 2 more faint ones, 2 to 3 cm wide, 12 to 14 cm long, glossy above and below, widest above middle, slightly wavy or recurved margined; inflorescence pyramidal, 12 to 18 flowered, with lower pedicels 14 to 15 cm long; buds green, turning to orange with faint touch of red overlay near tip or a flush of red extending halfway up or more; flowers orange, with flush of red distally, 13 cm in diameter, reverse same color with tinge of red on ribs and spots showing through on edges, tightly reflexed, throat open, very slightly ridged with base green, spotting which is blacker and smaller in throat covers entire petal, the distal ones being 2 to 3 mm in diameter and red with scarcely a suggestion of a darker center, gradually becoming redder toward the tip; anthers yellowish on center of valves but purplish red on sutures and pollen xanthine orange; sparsely stem-rooting with basal plate nearly horizontal; bulbs 9 cm in greatest diameter, showing tendency to split, forming two or three crowns on one or opposite sides of stem, white with pink blush on tips of scales and turning color on exposure, scales 5 to 6 cm long and 12 to 14 mm wide, jointed but external ones often indistinctly so.

Sacajawea differs from Kulshan in having glossy foliage and petals more pronouncedly red spotted instead of black. In stature it is similar to Star of Oregon, but the spots do not coalesce so much and are otherwise different.

[4] Pronounced Sa-ca-jaw′-e-a.

KULSHAN [5] (1370-O)

(*Lilium pardalinum* on *L. humboldti*. Pl. 4, C)

Kulshan is the aboriginal name of the most conspicuous snowy peak in the Bellingham region. As was his custom, Captain Vancouver renamed this prominent landmark Mount Baker, in honor of a member of his crew.

Plants under field conditions and rapid propagation 5 to 6 feet high, deep green with stems flecked with brown and black toward base; leaves 10 to 12, strongly 3-nerved, dull above and glossy beneath, 3 cm wide by 14 cm long, widest about the middle and tapering gradually toward each end, regularly moderately wavy and faintly hispidulously margined; inflorescence pyramidal, 10 to 20 flowered, with the basal pedicels 13 to 14 cm long, more or less colored; buds green, turning to a dull orange with a faint flush of red on outer petals toward anthesis while spotting shows through on their edges; flowers true martagon, tightly reflexed, deep cadmium orange with reverse same color but duller with dots showing through prominently on edges, prominently ridged in throat, green at base, spotting black in throat, becoming more red outward and covering the petal nearly or quite to the tip; anthers purplish red, pollen Mars orange; stem roots sparse but seldom entirely absent; bulb with axis pointing downward obliquely, showing tendency to divide into two points on same side of stem, often a bulblet or two formed on stem, oval, white, but old scales yellowish, scales jointed but often entire with dilated clasping bases, jointed ones 12 mm wide and 5 to 6 cm long, others larger, tip of bulb purplish tinged and turning purple on exposure.

Kulshan is the most densely and uniformly spotted of any of these spotted lilies.

JOHN McLAUGHLIN (1370-I)

(*Lilium pardalinum* on *L. humboldti*. Pl. 4, B, and pl. 6, B)

The John McLaughlin lily is named in honor of the most conspicuous and influential character in the early history of the Pacific Northwest, John McLaughlin, the chief factor of the Hudson Bay Co., who ruled so successfully from old Fort Vancouver for more than a quarter of a century.

Plants under field conditions and rapid propagation 5 to 6 feet high, deep green, with stems bronzing especially at articulation of leaves and toward base; lower leaves alternate, upper whorled, variable, from 2 above to 12 or 15 lower down, 2½ cm broad and 14 to 15 cm long, 3 to 5 nerved, uniformly wavy, nearly smooth margined, more glossy below; inflorescence pyramidal, 12 to 20 flowered, the lower on 14 cm pedicels; buds greenish turning to orange with faintest uniform blush of red with dots showing faintly toward anthesis; flowers deep cadmium with very faint flush of red over the distal one fourth or less of petals which deepens with exposure, 15 to 17 cm across, reflexed, and true martagon in position, sharply and well-ridged throat with green base, dull cadmium reverse with dots showing through faintly, dotting dense and black in center, larger and redder distally and extending over nearly whole of petal which is about 22 mm wide near throat and tapers gradually to dull point; anthers dull purplish red with xanthine orange pollen; stem roots few; base of bulb oblique, medium size, 7 to 8 cm in greatest diameter, yellowish white with blush of red in tips, turning red on exposure, showing tendency to make double crowns, one on each side of stem; scales about 5 cm long and 9 to 10 mm broad, mostly abundantly jointed but often entire or irregularly constricted.

This lily differs from Sacajawea in having darker spotting distally and more red in tips of petals. There is less red in the buds than in either Sacajawea or Star of Oregon.

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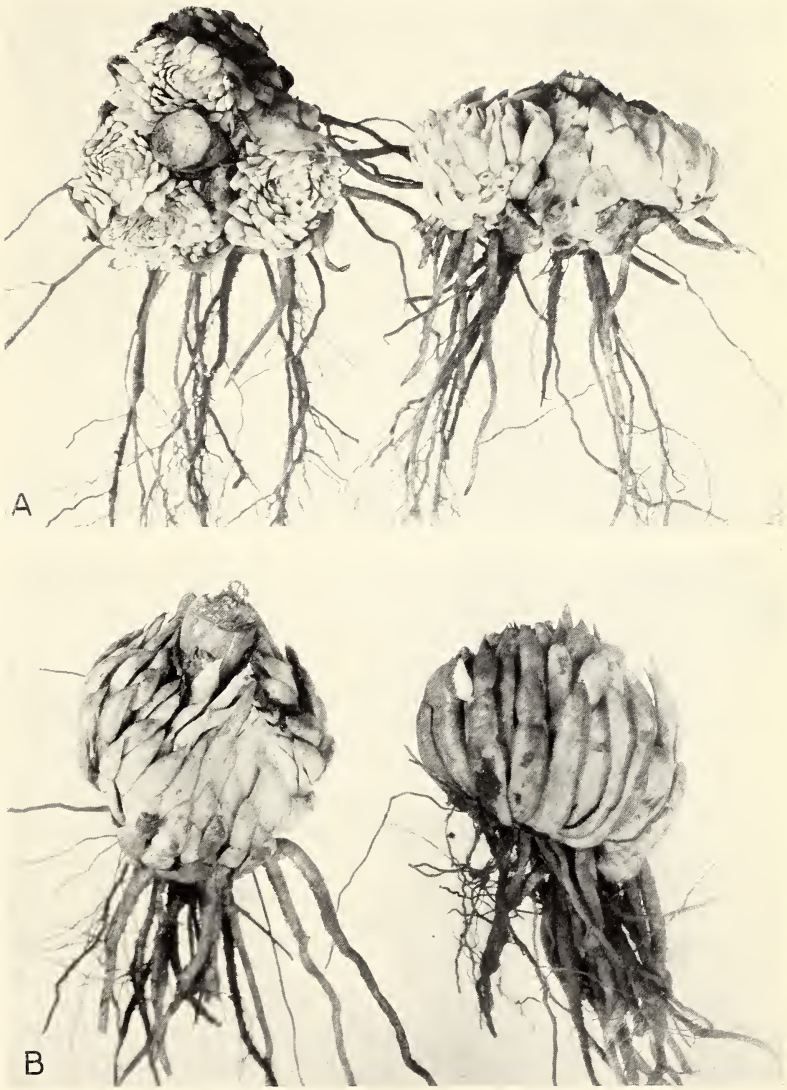
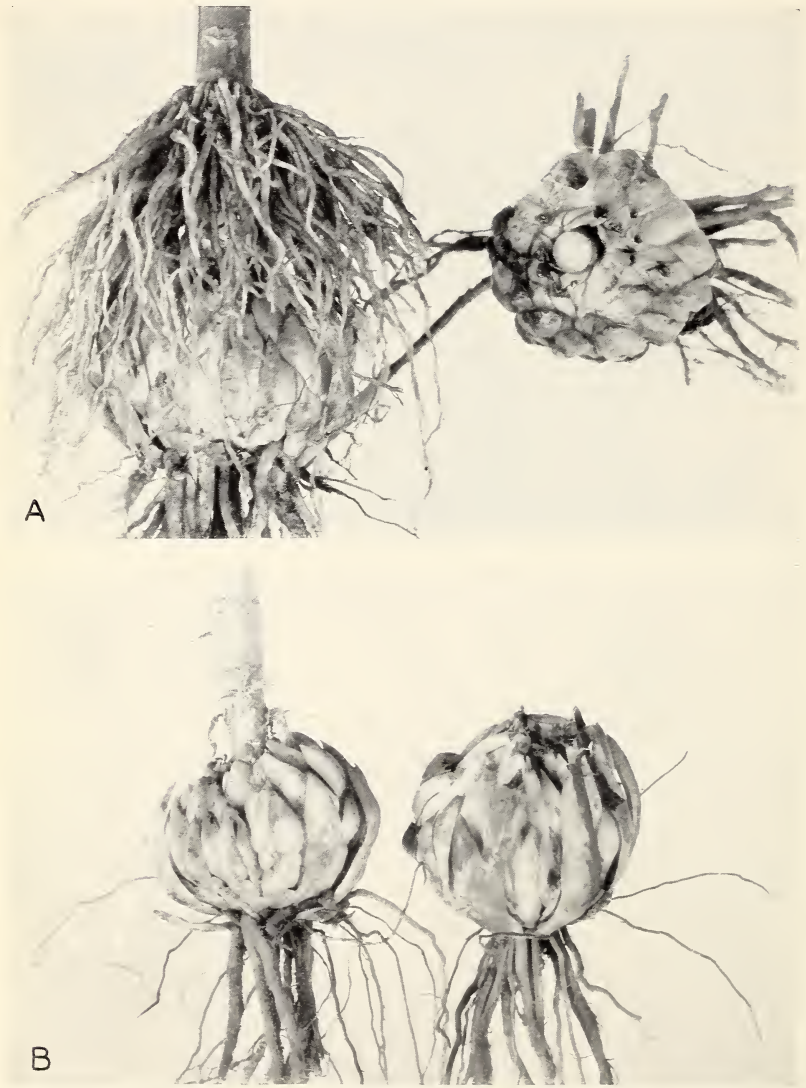
[5] Pronounced Kul'-shan.



A, Bulbs of Peter Puget the second year after closely dividing and scaling, one showing four crowns for the next year's performance. B, Bulbs of Frances Larrabee the second year undisturbed after close scaling, showing slightly constricted scales.



A, Bulbs of Cyrus Gates, showing the wealth of stem roots produced by this variety. B, Bulbs of John McLaughlin, showing paucity of root development on the stem.

DOUGLAS INGRAM (1370-R)

(*Lilium pardalinum* on *L. humboldti*. Pl. 3, A)

Douglas C. Ingram lost his life in the Chelan forest fire in August 1929. This hybrid lily, originated in the land of his adoption, is dedicated to his memory.

Plants under field conditions and rapid propagation 4 to 5 feet high, dark green inclined to bronze with stems and pedicels decidedly brown to black at base; leaves 10 to 18, whorled with a few above and below alternate, wavy margined, 3-nerved, dull above and glossy below, about 15 mm by 11 cm, widest about middle, acuminate pointed; inflorescence pyramidal, 15 to 20 flowered, with lower pedicels 13 to 14 cm long; buds green when young but becoming dull red at anthesis; flowers true martagon in position and strongly reflexed, orange red, clearer deep cadmium toward throat with an overlay of dull red outwardly over distal third of petal which is nearly or quite free of spots, the throat moderately ridged with green base, the spotting black and smaller in throat but larger and more red distally, the distal spots surrounded by a clear zone of red, reverse dull red on ribs, deep yellow to cadmium on edges with spots showing through faintly; anthers dull yellow with faint tinge of purple on edges, pollen cadmium yellow; nonstem-rooting with axis of bulb pointing downward obliquely; bulbs ovoid, about 8 cm in greatest diameter, white, yellow exteriorly and faintly purplish tipped, often only faintly jointed, 6 to 7 cm long and 10 to 12 cm wide, turning purple on exposure.

Douglas Ingram is a vigorous lily, but is dwarfer than most of its brothers and sisters.

SHUKSAN [6] (1370-F)

(*Lilium pardalinum* on *L. humboldti*. Pl. 4, E)

Shuksan is the name applied by both the aborigines and the white man to a beautiful snow-capped mountain 50 miles from the city of Bellingham. It is even more familiar to the tourist than the famed Mount Baker.

Plants similar to those of Cyrus Gates but more dwarf, 4 to 5 feet high under field conditions and excessive propagation, light green, bronzing of stem slight except at leaf attachment and toward base; leaves about 13, whorled except below, 3-nerved but wider ones in inflorescence 5-nerved, close to 2 cm broad and in well-grown plants 16 to 18 cm long, often spiraled, not wavy, dull above and glossy below with margins distinctly rough to touch; inflorescence pyramidal, 15 to 18 flowered, with basal pedicels 14 to 15 cm long; buds green, turning orange with pronounced blotching of red toward anthesis, the spotting showing through very faintly; flowers 15 to 16 cm in diameter, irregularly reflexed, true martagon, cadmium with a faint flush of red over the distal 2 cm of petal, which has sparse or may be free of dots, reverse cadmium overlaid with a faint flush of red over two thirds of central area and edges, with dots showing through faintly, the throat ridged moderately, green base, the dotting small, black toward center, enlarging to 3 or 4 mm outward where the dots have black centers surrounded by a red zone; anthers purplish red, deeper on edges, pollen orange rufous; sparsely stem-rooting with progressing rhizome pointing down at oblique angle; bulbs about 9 cm in greatest diameter, flattened, ovate with tendency to form two crowns either on opposite or on same side of stem, scales mostly 5 to 6 cm long and 2 cm broad, slightly jointed, yellowish white, pointed.

This lily differs from Cyrus Gates in smaller stature, in the distinct reddish cast of the buds, and in a duller-colored flower which is difficult to describe. It blossoms a week later than either Cyrus Gates or John McLaughlin.

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[6] Pronounced Shuk'-san.

SEASON OF BLOSSOMING

In 1931 this group of lilies began to blossom June 14, were at their best June 25, and all were out of blossom by August 1. The season was 10 days to 2 weeks earlier than normal. The first to open was Frances Larrabee.

The dates of complete fading of the last flowers for 1931 are given below. On account of digging for propagation on July 20, the dates following are estimates made at the time of digging.

Peter Puget	July 20
Frances Larrabee	July 15
Mercer Girl	July 10
Vashon	July 12
Cyrus Gates	July 25
Star of Oregon	Do.
Sacajawea	Aug. 1
Kulshan	July 25
John McLaughlin	July 20
Douglas Ingram	July 30
Shuksan	July 22

SIMILARITIES AND RELATIONSHIPS

These hybrids have been grown in a solid block of constantly increasing size for the last three biennial propagations, giving an excellent opportunity to secure a general impression of them in mass. They were grown five to the row across 3-foot beds, which gave ample space the first year after scaling but rather too dense a planting the second year. This sort of setting is the one most commonly employed at the Bellingham Bulb Station for lilies under field conditions, so that there has been ample opportunity to get a comparison between them and the general run of lilies.

They are to be compared as one would suppose with the west-coast Martagons, of which they are derivatives, but they present a very different aspect from any of these species and are more striking than any unless it be *Lilium humboldti*, which is in a class by itself and one of the world's grandest lilies. This lily, however, is seldom seen in large colonies under cultivation, because it is none too tractable in either field or garden.

The hybrids are particularly striking in stature (pl. 7). They have been "head and shoulders" (panicle of inflorescence or more) above all else grown under comparable conditions. Forms of *Lilium pardalinum* are robust, but these hybrids are taller and more striking. Three of those derived paternally from *L. pardalinum*—Star of Oregon, Kulshan, and Cyrus Gates—under the conditions of culture described, generally stand 5 to 7 feet or more high the second year after scaling; and 30 flowers to the stem is common for Frances Larrabee.

Lilies similar to some of the *Lilium pardalinum* × *L. humboldti* crosses, however, may sometimes be secured from trade sources in this country. They are most likely to be sold as *L. bloomerianum* or *L. humboldti magnificum* and sometimes as *L. pardalinum*. In the writer's opinion these hybrids are of unknown origin, as has been proved on one occasion by the splitting up of their seedlings in the same way as the seedlings of these hybrids behave.

The planting of hybrid lilies at the Bellingham Bulb Station in 1931, showing differences in the habits of some of them. Ends of four beds, each containing different varieties, are shown.

From a few European sources may be obtained *Lilium burbanki* and *L. paraboldti,* which are known to be of similar derivation. Under the conditions at the Bellingham Bulb Station both of these are apparently weaklings. The former is quite variable and certainly cannot be a clon. They are sufficiently distinct not to interfere with the lilies described here.

PROSPECTS OF FURTHER BREEDING

The lilies described in this circular, as has been pointed out, are first-generation hybrids. The breaking up of characters has been wonderfully diversified, giving a range of variation that would scarcely be expected.

During the time that stocks have been increasing, investigations have been conducted into the possibilities that exist in further breeding with the riot of color and form that resulted from the first crosses. In 1924 a considerable quantity of seed was made from pollinations between the best of these first-generation hybrids crossed promiscuously.

The second-generation seedlings thus produced showed their characters rather well as early as 1928, but instead of selections being made then, the entire stock of individual seedlings was dug, lined out, well spaced, and left for 3 years undisturbed. Studies and comparisons made in 1931 showed that about 10 of these are worthy of being segregated for the purpose of establishing clons, and their natural reproduction justifies the belief that they will prove to be good doers.

In the interim the best of the first-generation hybrids have been crossed with one another and with the parental species. At the present time fully three dozen progenies of seedlings obtained in this way are being grown. Some of these blossomed in 1931 for the first time and show enough character already to justify the prediction that from them will come as large a proportion of good and different lilies as have resulted from the first-generation and second-generation promiscuous crosses.

The use of *Lilium parryi* and its derivatives has been emphasized in these later crosses, and the indications are that a number of desirable yellows of the general aspect of Mercer Girl, Vashon, and Frances Larrabee will result.

The scattering flowers that appeared in 1931 suggest that it might be possible to improve this group of lilies by adopting the method of propagation long employed in connection with daffodils, namely, taking advantage of each new break and improved form in breeding to pass these changes on to the new generations. Already there are indications that some of the later crosses between the best hybrids have a pronounced increase in floral dimensions. From work already under way it seems that from this series of crosses there will result not less than 30 lilies worthy of a place in the garden. They will range in color from pure lemon through orange, cadmium, and red to a dark brown that is almost black in general appearance.

Crosses of *Lilium pardalinum*, *L. parryi*, and *L. humboldti* have yielded thus far only maternal inheritance in the seed characters. The varieties herein described, except Peter Puget, are all *L. pardalinum* or *L. parryi* on *L. humboldti* and bear seed resembling the mother parent. Other crosses, the reciprocal of these, show again only maternal inheritance in seed characters, it being invariably of the *L. pardalinum* or *L. parryi* type.

Further crossing of these two lines of descent may break up the seed characteristics, and more than likely accompanying this may occur other advantageous plant and floral modifications. This is another promising line of breeding that has not been touched.

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